

COSTING THE OMNIUM-G SYSTEM 7500

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Abstract

A complete Omniium-G System 7500 was cost analyzed for annual production quantities ranging from 25 to 100,000 units per year. Parts and components were subjected to in-depth scrutiny to determine optimum manufacturing processes, coupled with make or buy decisions on materials and small parts. When production quantities increase -- both labor and material costs reduce substantially. A redesign of the system that was analyzed could result in lower costs when annual production runs approach 100,000 units/year.

Objective/Purpose

The principal objective of this study was to determine the production cost of the complete Omniium-G System 7500 solar collector for various annual production volumes of 25, 100, 25,000 and 100,000. The purpose of this study by JPL was to establish a "baseline" to which other designs of point focusing distributed receiver components, subsystems and systems could be compared for cost and performance.

Introduction

The Omniium-G System 7500 Parabolic Concentrator (Figure I) is a parabolic dish, six meters in diameter, composed of 18 reflector petal segments. This assembly is articulated in both elevation and azimuth, thus enabling it to track the sun from horizon to horizon. The reflector segments are fabricated from electrochemically polished (Alzak) aluminum which is bonded to a polyurethane substrate.

The concentrator focuses the rays of the sun onto a receiver that is 3.9 meters in front of the mirror center. This receiver acts as a heat exchanger, boiling water which is contained in a helical tube and thereby producing steam. The steam in turn powers a steam engine which turns a generator producing electricity.

This study estimated the cost of direct labor and material which results in a cost number. No attempt was made to estimate the selling price of the system or its components.

No capital equipment costs were considered. A figure of \$10.00/hr was applied for direct labor.

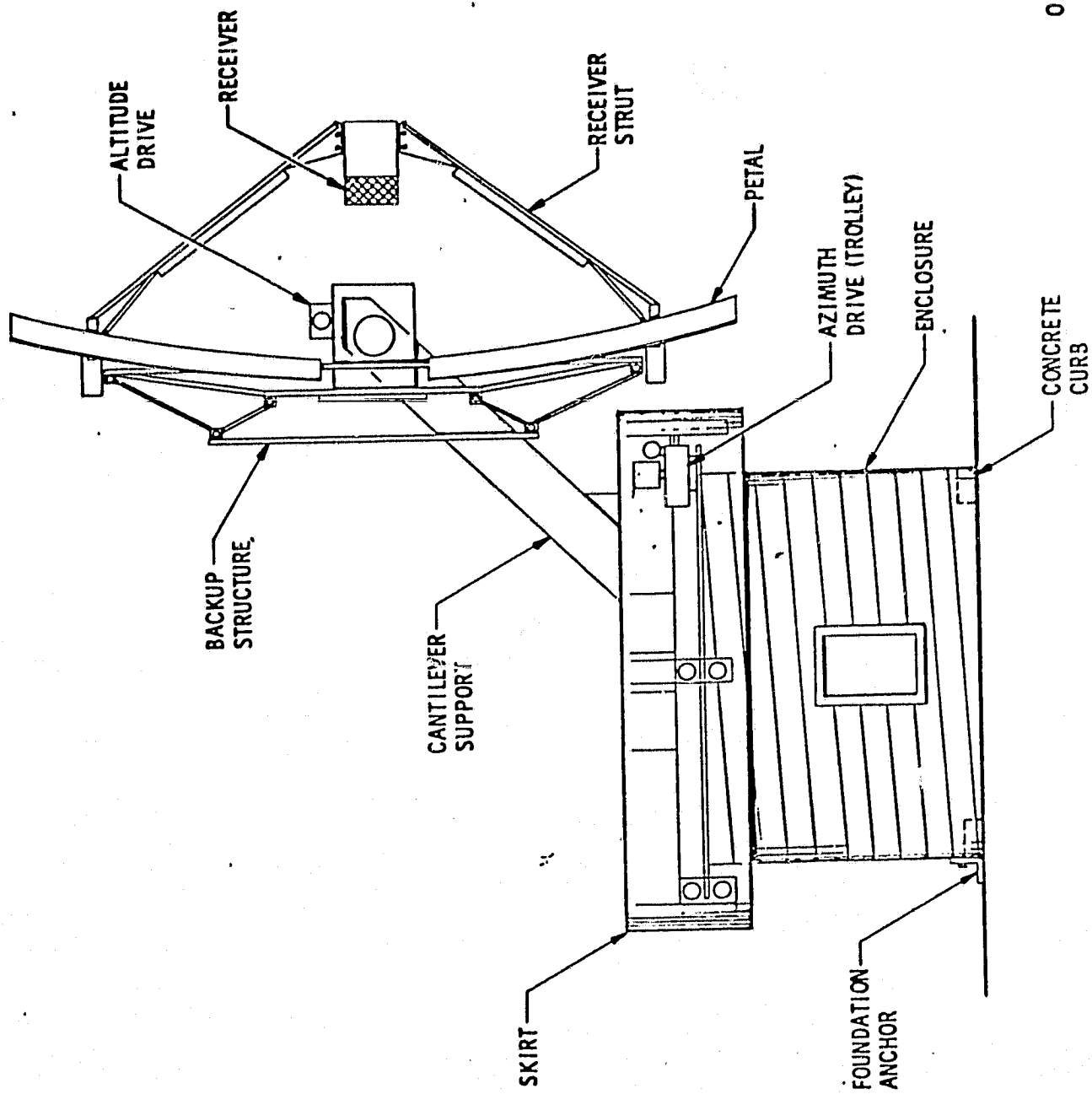


FIGURE NO. 1

Methodology

Each part, component, assembly (major and minor) and the final assembly was examined and evaluated as to its material cost and method of manufacture based on the particular annual production volume under review.

The evaluation was performed primarily by carefully examining actual parts and the manufacturing procedures as performed at the Omnium-G facilities in Anaheim, California. The original evaluation was based on a production rate of less than fifty (50) units during the calendar year 1979.

For very low production volumes of 25 to 100 units per year the manufacturing costs of this Omnium-G 7500 System are extremely labor intensive and expensive. At the higher annual production volumes, the labor content is reduced with an increase in capital equipment.

The JPL cost analysis of the Omnium-G 7500 System required the preparation of the following:

- a. Engineering parts lists
- b. Detail drawings
- c. Raw material costs
- d. Part manufacturing process
- e. Labor hours to produce each part estimate
- f. Assembly labor hours estimate

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It was assumed that for small production runs of 25 to 100 units per year, most of the items would be purchased and assembled in an in-house facility. However, it is important to note that the steam engine is presently being made by Omnium-G in their own facility.

When production increases to 25,000/year, it was assumed that a make or buy decision would be made to obtain the lowest cost based on a tradeoff of capital investment versus direct labor cost. Again the assembly would be in-house. At this production level, a complete system must be produced every four (4) minutes with a single shift of 8 hours/day.

As production increases to 100,000/year, it was assumed that most items would be made in-house with an investment in the necessary tooling and capital equipment. Assembly would be in-house and would require a complete system every minute based on an eight hour working day.

Results

The cost estimates for the complete Omnium-G System 7500 are shown in Table 1. The table has complete costs for labor and material for each of the four annual production volumes studied. Figure 2 is a bar chart that graphically illustrates the System 7500 reduction in cost as the production volume increases.

As quantity production increases, both labor and material show significant cost reductions.

SUMMARY

PRODUCTION QUANTITIES AND COSTS PER UNIT

SUB-ASSEMBLY	25 UNITS		100 UNITS		25,000 UNITS		100,000 UNITS	
	MATL	LABOR	MATL	LABOR	MATL	LABOR	MATL	LABOR
Receiver Assembly	391.27	120.50	378.57	114.50	291.20	80.15	213.55	45.80
Backup Structure	476.57	171.10	379.17	162.50	270.63	113.80	155.56	65.00
Petal Assembly	3,066.84	78.00	2,877.63	75.00	2,100.60	30.00	1,540.29	13.40
Receiver Mount	169.24	17.90	166.00	17.00	126.46	12.00	93.08	6.80
Control Support	842.78	151.60	743.98	144.00	565.24	100.80	420.38	57.60
Elevation Mechanism	601.37	44.70	586.14	42.50	451.03	29.75	330.35	17.00
Gazimuth & Trolley Assy	746.18	93.20	642.96	88.50	494.69	62.00	362.70	35.40
Hydro Assembly	175.34	73.70	170.95	70.00	119.67	49.00	70.14	28.00
Base Assembly	336.61	82.60	326.29	78.50	252.46	55.00	198.89	31.40
Electrical	288.50	85.80	288.50	81.50	216.38	57.10	156.68	32.60
Foundation	550.05	766.20	550.05	727.85	385.04	673.25	220.02	545.89
Steam Engine	123.15	335.50	123.13	318.70	92.34	218.30	73.88	127.50
Condenser	41.85	23.00	41.85	21.80	31.39	15.26	25.11	8.70
Air-heater	20.40	11.60	20.40	11.00	15.30	7.70	12.24	4.40
Flue Wall	797.96	30.50	797.96	29.00	638.37	20.40	478.77	11.60
Power Cart	2,396.89	73.70	2,396.89	70.00	1,797.66	49.00	958.75	28.00
Transport	438.77	39.30	438.77	37.33	329.08	13.63	223.77	5.98
TOTALS	11,463.75	2,199.90	10,929.24	2,089.68	8,177.54	1,587.14	5,534.16	1,065.07
GRAND TOTALS (MATL + LABOR)	\$ 13,663.65	\$ 13,018.92	\$ 9,764.68	\$ 6,599.23				

TABLE 1

OMNIUM-G SYSTEM 7500
COST AS A FUNCTION OF PRODUCTION VOLUME

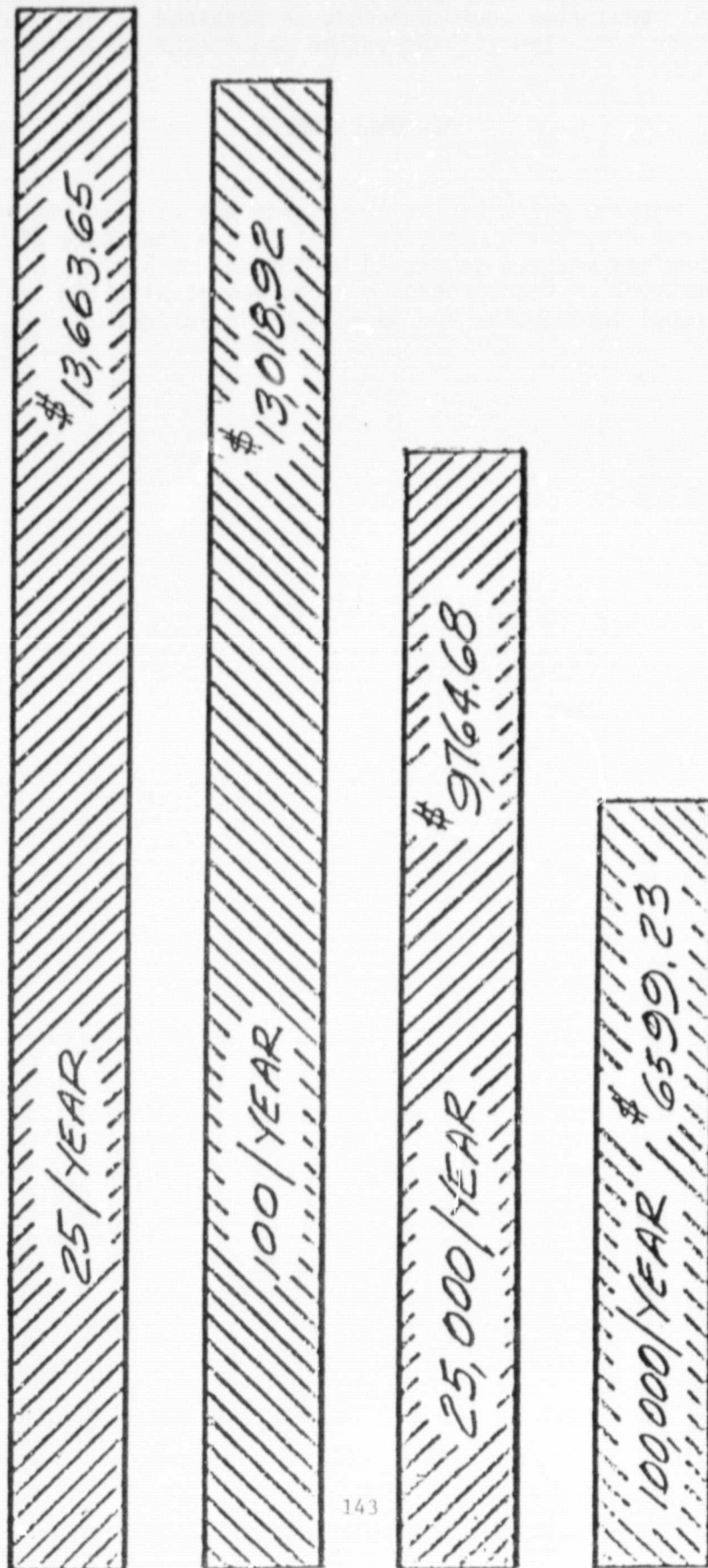


FIGURE 2

The Omnium-G System 7500 that JPL evaluated was an existing design. No attempt was made to modify the design with an eye to reducing cost, however, significant cost reductions could possibly be obtained if the system were redesigned to take advantage of high volume manufacturing techniques.

ACKNOWLEDGEMENT

The research described in this paper was carried out at the Jet Propulsion Laboratory/California Institute of Technology and was sponsored by the United States Department of Energy through an agreement with the National Aeronautics and Space Administration.